PLANT MATERIALS TECH NOTE

Establishment of Woody Plants on CRP and within Native Range Communities

Introduction: Recent Conservation Reserve Program (CRP) sign-ups may include the use of woody plant materials (shrubs and trees) as part of the revegetation or restoration effort. Given that most acres enrolled in CRP in Wyoming were historically grasslands, the inclusion of woody species poses some unique selection, establishment, and maintenance challenges when planning and implementing these plantings.

Planting Design: The purpose of planting shrubs is to re-establish native plant communities and associated wildlife. Woody planting designs should result in curvilinear, clumped mosaic, patchy designs, or combinations thereof, thus providing niche communities of habitat and complementing adjacent vegetation.

Species Selection: Program goals will determine which species can be used and will dictate the use of native or introduced species.

Site Selection: Site selection is critical to the successful establishment of a shrub component. The high expense of woody seed and plants dictates that planting occurs in environments providing the greatest probability of success. Therefore, identify favorable planting sites, e.g., deep soils, overflows, coulees, swales, and lower terrace geophysical landscapes. One strategy is to establish plants as seed orchards on the upwind side of a planting site, to provide a seed source, for eventual occupation in adjacent plant communities (When applicable, assure that both female and male plants are present).

Germplasm Origin and Source: The *origin* and *source* of the woody species (seed or plant) is often critical to their successful establishment and long-term survival. "Origin" refers to the original collection site of the plant material and provides insight into the site and environmental conditions to which the collection is adapted. In most cases, local ecotypes will outperform nonlocal sources in terms of long-term survival. Cultivars that have been through a testing and/or selection program and are recommended for the location and use are preferred. Cultivated but nontested local ecotypes are less desirable than tested material, but more desirable than local, wildland collections. "Source" refers to the supplier of the seed or plants, i.e., nursery, seed supplier, etc. Given the appropriate origin of the material, plants should be procured from local nurseries when possible. Plants of appropriate origin but produced in distant, milder environs should be adapted, but seedlings may not be properly conditioned to Wyoming climates. Local state forest tree nurseries, commercial nurseries, and seed growers are preferred sources.

Site Preparation: Site preparations for seeding should follow standard guidelines for establishing a firm, weed free bed for good soil:seed contact (512, Pasture and Hayland Planting or 327, Conservation Cover). Site preparation for planting bareroot or containerized plants will involve mechanical cultivation or chemical fallow, possibly in conjunction with weed barrier, at least one year prior to planting. In established grasslands, this will require preparing a strip, circle, or square around each plant. Minimum grass-free area should be a 3-ft wide row or a 3-ft diameter around each plant. Like windbreak plantings, the cultivation of the area is dictated by equipment size and must be planned accordingly.

I. SEED

Seed Dormancy: In contrast to most grass species, most woody plants have one or more dormancy mechanisms that prevent germination until conditions are favorable for long-term survival. Commercial seed is not artificially pretreated, and cooperator pretreatment is not reliable. Germination recommendations call for direct field sowing at a particular time of the year, depending on the species, to overcome this dormancy. The result is that the interval from sowing to germination may be lengthy, possibly up to several years, for snowberry and black hawthorn. For best results, multiple year sowing or alternate shrub-grass strip planting operations may be needed in order to limit competition from aggressive cool-season grasses. Woody species requiring little or no pretreatment, such as saltbushes and winterfat, may be simultaneously sown with herbaceous plants, depending on the physical characteristics of the woody seed and the species mix**. In most cases, however, grass competition and long-term costs favor the use of bareroot or containerized woody material over seed.**

Seed Viability: Only high quality seed with a current (<12 months) germination and analysis should be used. Seed should be stored in a cool, dry environment. Shelf life varies by species and may be as short as six months for select sagebrush species and two years for winterfat.

Direct Seeding: Seeding rates for shrubs should be relatively high when mixed with competitive grasses and forbs (Table 1). Depending on the species, large seed can be drilled to a 1.0-inch depth, whereas small seed should be planted 0.5 or less inches deep. Sagebrush and winterfat should be planted near the soil surface. Planting depth will also vary as a function of the moisture holding capacity of the soil, e.g., soil texture, exposure, aspect, etc. Compromises may be needed when multiple species of one or more life forms are sown in a single operation. One option is to partition the drill box into multiple compartments so that separate rows of shrubs, grasses, legumes, and forbs are seeded. Shrub rows should be at least 3 feet from the nearest grass row. Carriers may be needed to equilibrate the drill settings for the various species as well as facilitate uniform and accurate seed distribution across the site. On adequately prepared sites, broadcast seeding with a fertilizer spreader or Brillion broadcast seeder is possible. This technique may be favored for small-seeded species. Increase the drilled seeding rate to 2X when broadcasting. **Interseeding is not recommended when competition is not controlled by either cultivation or herbicides.**

II. Plants

Plant Codes: The nursery industry employs a numeric coding system to identify how the stock was grown and for how long. The first number indicates the number of years a seedling was grown in a seedbed, the second number indicates the number of years grown in a transplant bed (e.g. a 2-0 plant was grown for two years as a seedling in a seedbed, a 2-1 plant was grown for two years in a seedbed and one year in a transplant bed and is therefore 3 years old).

Plant Condition: All plants should be healthy, vigorous, and free from any signs of insect, disease, mechanical injury, or signs of environmental or other stress. When plant material is installed outside of the frost-free period established for the planting site, it should be maintained and planted in a fully dormant state. For dormant fall plantings, all leaves should have naturally dehisced by the time of planting. For dormant spring plantings, buds should not be swollen nor should there be any other signs of active growth. Actively growing plants may only be installed within the frost-free period established for the planting site. The bark cambium should be smooth and tight (not wrinkled and/or water-soaked in appearance) and free from mechanical injury. Roots should be healthy and prolific, with light colored root tips and free of signs of insects, disease, mechanical damage, or environmental stress. Bareroot and container plant root systems should not have any girdling, twisted, or circling roots. Container plants should be properly hardened-off (acclimated to outdoor conditions) prior to delivery.

Plant Transport and Storage: The proper transport and storage of plants are critical factors influencing plant condition and planting success. Dormant plants should be shipped and stored under refrigerated (34°-37°F) and high humidity (95+%) conditions. All plant material transported to the planting site under non-refrigerated conditions should be transported in packages that prevent heat build up and the loss of relative humidity and should be installed within 72 hours of leaving cold storage at the nursery. All plant

material transported to the planting site in refrigerated storage and placed directly in on-site refrigerated storage may be held on-site for up to 14 days prior to planting. Plant material that is transported in cold storage but not subsequently maintained in on-site refrigerated storage should be installed within 72 hours of removal from refrigerated transport. All bareroot material should have their roots kept in moist packing material wrapped in polyethylene sheeting during transport. Plants grown in containers should have their growing media kept moist at all times. If actively growing, container plants should be transported and stored under conditions that favor active growth (45°-75°F; light sun; moisture). All plants should be fully protected from wind and sun desiccation during transport (tarps, protective boxes, caps, etc.). Upon arrival at the planting site and prior to planting, plants should be temporarily stored in a cool, shaded (dark), wind-protected area such as on the north side of a building, under a tent, or under trees. The roots should be kept cool and moist to prevent desiccation and maintain good plant health until they are installed. Plants should be protected from heat build-up; sun, air, and wind desiccation; freezing; and animal predation at all times. Minimize the interval between removal of dormant plant material from cold storage and final planting. All plants should be handled so as to eliminate potential stress or injury.

Maintenance: Weed control prior to planting and until the woody plants can successfully compete with grasses is needed. Weed barrier, chemical fallow, or mechanical cultivation may be needed around each plant to optimize moisture availability and minimize competition. Weekly watering during the first growing season is advised in annual precipitation zones of 10 inches or less.

Protection: Newly planted woodies can be protected from sun and wind stress with shingles or other shading devices. In areas with a high probability of animal predation, protective structures such as mesh-type, ventilated, plastic tubes are recommended. Hardware cloth can be used around the base of each plant to prevent girdling. Antitranspirants, a waxy emulsion sprayed over stems or foliage after transplanting may be used at planting time or over the winter to prevent seedling desiccation.

A. Bareroot

Bareroot Stock: Bareroot plants are shipped and planted in a dormant state without growing media protecting their roots. This stock is less expensive than containerized material and is acceptable for many species. Shipping, storage, handling, and planting of bareroot stock is more timing-critical than container plants because this stock is handled dormant and desiccation of the roots is more likely. Bareroot plants need to be shipped and planted in the early spring before bud break or in the fall after leaf drop. If bareroot plants do break dormancy, they should only be planted within the frost-free period established for the planting site.

Bareroot Plant Material Specifications: Optimal sizes for bareroot material includes a shoot to root ratio of 1:1 to 1:2. Shoots not less than 8 inches tall with a basal diameter of not less than 3/8 inch are best. Each bareroot plant should have at least 4, 8-inch long, fibrous roots originating from the stem. All plant material should have a well-branched root system characteristic of the species and adequately sized to support vigorous plant growth under prevailing site conditions. A minimum of one-year-old deciduous stock (1-0) and two-year-old conifer stock (2-0) is recommended. Evergreens establish most successfully as containerized transplants.

Bareroot Planting: Bareroot plants should be planted in accordance within accepted horticultural and forestry guidelines for the successful establishment of bareroot plants. The planting hole should accommodate the entire length and width of roots without necessitating any bending or manipulation of the roots. Bareroot plants should be planted so that all root surfaces make contact with soil with no roots exposed to air. No soil should cover or be mounded around any stem tissue above the root collar. The hole should be backfilled with native (native to the planting site), friable soil and all large air spaces eliminated by saturation with water. Extreme care not to damage the root system should be exercised if physical packing of the soil is necessary. Excessive downward force on the roots may cause tearing from the stem. All bareroot plants should be installed so that the main stem(s) are vertical.

B. Container

Container Stock: Woody plants grown in containers offer the best survival and growth. Although initially more expensive than bareroot material, container plants are often as or more cost efficient in the long-term. Containerized stock offers more flexibility in the timing of planting and the method of storage prior to planting. Conifer species, with roots sensitive to desiccation, lend themselves best to container production (Table 1). Replanting costs are often lower as a result of superior seedling survival and growth rates, reduced transplanting shock, and hence, better competition with grasses. Container plants are installed with rooting media, providing an establishment advantage on marginal sites. Container plants, with their superior growth rates, often reach a functional size more quickly than bareroot plants and thus provide conservation benefits sooner. **Actively growing plants should only be planted within the frost-free period established for the intended planting site.**

Container Plant Specifications: Containerized plants should have a container (media and root) volume of not less than 7 cubic inches. Volumes of 10 to 40 cubic inches are preferred. Properly aged and sized container plants should consist of enough fibrous root mass to retain the shape of the media when removed from the container. Container plants should be at least 2 years old.

Container Planting: All containers should be removed at the time of planting. The width of the planting hole should be 1.5 times the diameter of the container and the depth of the hole 1.5 times the depth of the container. The hole should be backfilled with native, friable soil so that the depth of the hole prior to planting is the same as the depth of the container. Each plant should be installed so that the surface of the root ball is level with the grade of the soil at each respective hole. No more than 1/2 inch of native soil should cover the surface of the root balls. The surface of the root balls may not be more than one inch below grade. All container plants should be installed so that the main stem(s) are vertical.

C. Other

Using Wildland Plants: The collection of wildland seedlings is not recommended. Wildland seedlings are difficult to transplant and the site from which they are collected may be adversely impacted during the transplanting process.

Using Vegetative Cuttings: Although vegetative cuttings can be used to establish new plants in a cultivated (greenhouse or nursery) setting, direct field sticking of cuttings is not practical nor recommended. Vegetative cuttings of select species can be successfully used in riparian settings given adequate and consistent soil moisture. Reference 391, Riparian Forest Buffer Standard, and *The Practical Streambank Bioengineering Guide* for further information.

Using Table 1: Seeding and planting information is provided in Table 1. Approximate number of seeds/pound is provided for calculating seeds/square foot and for determining seeding methodologies. It may be difficult or impossible to plant very small or large seed with mechanical planters at the recommended rates. In addition, carriers may be needed. **Seeding rates are based on reclamation estimates for establishing a 100 percent stand and need to be adjusted accordingly**. As a result of variability in seeds/pound, germination rates, site conditions, and environmental factors, these rates represent approximate estimates and accuracy may be improved by adjustment based on known or estimated project-, site-, and seed lot-specific conditions. It should again be noted that plants are preferred to seed.

Example: A 20 percent stand, consisting of equal parts of big sagebrush, Gardner's saltbush, and silverberry, is desired. The seeding rate for each species is calculated as follows:

1) big sagebrush (1.0 PLS pounds/acre) x (0.066 percent[†]) = 0.066 PLS pounds/acre (30 grams)
2) Gardner's saltbush (0.5 PLS pounds/acre) x (0.066 percent) = 0.033 PLS pounds/acre (15 grams)
3) silverberry (1.0 PLS pounds/acre) x (0.066 percent) = 0.066 PLS pounds/acre (30 grams)

Mix Totals: 0.165 PLS pounds/acre (75 grams)

[†] Calculated by dividing 20 percent by 3 species.

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Table 1. Establishment of Woody Plants on CRP and in Native Range Communities.

Common Name	Latin Name	Potential for Direct Seeding (l,m,h)[1]	Approximate Seeds per Pound	Seeding Rate Pounds (PLS/acre)[3]	Method of Seeding (b or d)[5]	Depth of Seeding (inches)	Seeded Alone or in Mixes	Seeding Time of Year (w,sp,s,f)[6]	Bareroot	Container	Planting Time of Year (w,sp,s,f)[6]
box elder	*Acer negundo*	l	13,400	0.25-0.5	NI	NI	alone	f	good	good	sp
serviceberry	*Amelanchier alnifolia*	l	82,000	0.5-1.0	d	<0.5	alone	f	good	excellent	sp
green sagewort	*Artemisia campestris*	m	4.5-4.7 million	<0.5	b	surface	mix	w to sp	NI	NI	NI
silver sagebrush	*Artemisia cana*	m	850,000	<1.0	b	surface	alone	f	good	good	sp
fringed sagewort	*Artemisia frigida*	m	3.9-4.5 million	ounces	b	surface	mix	f,sp	NI	NI	NI
cudweed sagewort	*Artemisia glomerata*	m	3.0-4.5 million	<0.25	b	surface	mix	f	NI	NI	NI
big sagebrush	*Artemisia tridentata*	l	2.4-3.2 million	1.0	b	surface	mix	f	good	excellent	sp
Gardner's saltbush	*Atriplex gardneri*	m	111,500	0.5	b,d	surface-0.5	alone	f	NI	good	sp
fourwing saltbush	*Atriplex X aptera*	h	52,000	0.5-1.0	d	0.25-0.75	mix	s,f	good	good	sp
curlleaf mt. mahogany	*Cercocarpus ledifolius*	l	51,900	1	b,d	surface-0.5	alone	f,w	good	good	sp
rubber rabbitbrush	*Chrysothamnus nauseosus*	m	693,000	<1.0	b	surface	lite mixes[7]	f	good	good	sp
green rabbitbrush	*Chrysothamnus viscidiflorus*	m	782,000	<0.5	b	surface	lite mixes[7]	f	NI	good	sp
redosier dogwood	*Cornus sericea*	l	18,500	1.0 or >	d	0.25-0.50	alone	f	good	good	sp
black hawthorn	*Crataegus douglasii*	l	22,600	0.5-1.0	b,d	surface-<0.25	alone	f	NI	good	sp
silverberry	*Elaeagnus commutata*	m	3,800	1.0-2.0	b,d	surface-1.0	alone	f,w,sp	good	good	f,sp
green ash	*Fraxinus pennsylvanica*	m	17,260	<0.25	b,d	0.25-0.75	alone	f	good	good	sp
common juniper	*Juniperus communis*	l	36,500	<1.0	b,d	surface-0.25	either	s,f	good	excellent	sp
horizontal juniper	*Juniperus horizontalis*	l	29,500	<1.0	b	surface	either	s,f	good	excellent	sp
Rocky Mountain juniper	*Juniperus scopulorum*	l	27,100	<1.0	b,d	surface-0.25	either	s	good	excellent	sp
winterfat	*Krascheninnikovia lanata*	h	111-210,000	b=<1.0;d=<0.5	b;d	surface;<0.5	use carrier	f to sp	excellent	excellent	sp
bush cinquefoil	*Pentaphylloides floribunda*	m	>1,000,000	<1.0	b	surface	mix	f,sp	good	good	sp
narrowleaf cottonwood	*Populus angustifolia*	l	NI[2]	NA[4]	NA	NA	NA	NA	good	excellent	sp
Plains cottonwood	*Populus deltoides*	l	350-477,000	NA	NA	NA	NA	NA	good	excellent	sp
black cottonwood	*Populus trichocarpa*	l	NI	NA	NA	NA	NA	NA	good	excellent	sp
American plum	*Prunus americana*	l	870	20.0	d	1.0	alone	f	good	excellent	sp
chokecherry	*Prunus virginiana*	m	4,790	1.0-2.0	d	0.5-1.0	either	f	good	excellent	sp
antelope bitterbrush	*Purshia tridentata*	m	15,400	1.0-2.0	d	1.0	alone	f to sp	good	excellent	late sp
bur oak	*Quercus macrocarpa*	l	75	25.0	hand	1.0	alone	f	fair	excellent	sp
skunkbush sumac	*Rhus trilobata*	l	20,300	1.0-2.0	d	0.5-1.0	either	f,w	good	excellent	sp
Wood's rose	*Rosa woodsii*	l	50,000	0.5-1.0	d	0.5	alone	f	excellent	excellent	sp
willow	*Salix* species	l	2-3,000,000+	NA	b	surface	alone	sp	excellent	exxcellent	sp
silver buffaloberry	*Shepherdia argentea*	l	40,000	0.5-1.0	d	0.5	alone	f	good	excellent	sp
common snowberry	*Symphoricarpos albus*	l	76,000	1.0-3.0	b,d	surface-0.5	alone	f	good	excellent	sp
western snowberry	*Symphoricarpos occidentalis*	l	74,400	1.0-3.0	b,d	surface-0.5	alone	f	good	excellent	sp
yucca, soapweed	*Yucca glauca*	l	25,000	<1.0	d	0.5	alone	f	NI	NI	NI

[1] l=low; m=medium; h=high

[2] NI=No Information

[3] PLS=Pure Live Seed in pounds; Based on reclamation rates designed to establish a 100 percent shrub component of a single species (adjust for multiple spec

[4] NA=Not Applicable

[5] b=broadcast; d=drilled

[6] w=winter; sp=spring; s=summer; f=fall

[7] Use other species at light rates